

TO-92



Pin Definition:

1. Emitter
2. Collector
3. Base

PRODUCT SUMMARY

BV_{CEO}	400V
BV_{CBO}	800V
I_C	1.5A
$V_{CE(SAT)}$	0.8V @ $I_C / I_B = 1A / 0.25A$

Features

- High Voltage
- High Speed Switching

Structure

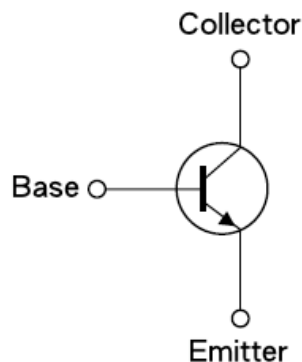
- Silicon Triple Diffused Type
- NPN Silicon Transistor

Ordering Information

Part No.	Package	Packing
TS13003MVCT B0	TO-92	1Kpcs / Bulk
TS13003MVCT A3	TO-92	2Kpcs / Ammo
TS13003MVCT B0G	TO-92	1Kpcs / Bulk
TS13003MVCT A3G	TO-92	2Kpcs / Ammo

Note: "G" is denote Halogen Free Product.

Block Diagram



Absolute Maximum Rating (Ta = 25°C unless otherwise noted)

Parameter	Symbol	Limit	Unit
Collector-Base Voltage	V_{CBO}	800	V
Collector-Emitter Voltage ($V_{BE}=0$)	V_{CES}	800	V
Collector-Emitter Voltage	V_{CEO}	400	V
Emitter-Base Voltage	V_{EBO}	9	V
Collector Current	DC	1.5	A
	Pulse	3	
Total Power Dissipation Tc=25°C	P_D	5.8	W
Operating Junction Temperature	T_J	+150	°C
Operating Junction and Storage Temperature Range	T_{STG}	- 55 to +150	°C
Thermal Resistance Junction to Case	$R\theta_{JC}$	21.5	°C/W

Electrical Specifications ($T_c = 25^\circ\text{C}$ unless otherwise noted)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Static						
Collector-Base Voltage	$I_C = 1\text{mA}, I_E = 0, t = 300\mu\text{s}$	BV_{CBO}	800	--	--	V
	$I_C = 1\text{mA}, I_E = 0, T_c = 125^\circ\text{C}, t = 2\mu\text{s}$		830	--	--	
Collector-Emitter Sustaining Voltage	$I_C = 1\text{mA}, I_B = 0, t = 300\mu\text{s}$	BV_{CES}	830	--	--	V
	$I_C = 1\text{mA}, I_B = 0, T_c = 125^\circ\text{C}, t = 2\mu\text{s}$		830	--	--	
Collector-Emitter Breakdown Voltage	$I_C = 10\text{mA}, I_B = 0$	BV_{CEO}	400	--	--	V
Emitter-Base Breakdown Voltage	$I_E = 1\text{mA}, I_C = 0$	BV_{EBO}	9	--	--	V
Collector-Emitter Cutoff Current	$V_{CE} = 400\text{V}, I_B = 0$	I_{CEO}	--	--	1	μA
Collector Cutoff Current	$V_{CB} = 800\text{V}, I_E = 0$	I_{CBO}	--	--	1	μA
Emitter Cutoff Current	$V_{EB} = 9\text{V}, I_C = 0$	I_{EBO}	--	0.1	1	μA
Collector-Emitter Saturation Voltage	$I_C / I_B = 0.5\text{A} / 0.1\text{A}$	$V_{CE(SAT)1}$	--	0.2	0.5	V
	$I_C / I_B = 1.0\text{A} / 0.25\text{A}$	$V_{CE(SAT)2}$	--	0.35	0.8	
	$I_C / I_B = 1.5\text{A} / 0.5\text{A}$	$V_{CE(SAT)3}$	--	0.6	1.5	
Base-Emitter Saturation Voltage	$I_C / I_B = 0.5\text{A} / 0.1\text{A}$	$V_{BE(SAT)1}$	--	--	1.1	V
	$I_C / I_B = 1.0\text{A} / 0.25\text{A}$	$V_{BE(SAT)2}$	--	--	1.3	
DC Current Gain	$V_{CE} = 2\text{V}, I_C = 10\text{mA}$	h_{FE1}	15	--	--	
	$V_{CE} = 2\text{V}, I_C = 400\text{mA}$	h_{FE2}	20	--	40	
	$V_{CE} = 2\text{V}, I_C = 1\text{A}$	h_{FE3}	6	--	20	
DC Current Gain	$V_{CE} = 2\text{V}, I_C = 400\text{mA}, T_c = 120^\circ\text{C}$	h_{FE4}	15	--	25	
Dynamic						
Frequency	$V_{CE} = 10\text{V}, I_C = 0.1\text{A}$	f_T	4	--	--	MHz
Output Capacitance	$V_{CB} = 10\text{V}, f = 0.1\text{MHz}$	C_{ob}	--	21	--	pF
Resistive Load Switching Time (Ratings)						
Delay Time	$V_{CC} = 125\text{V}, I_C = 1\text{A}, I_{B1} = I_{B2} = 200\text{mA}, t_p = 25\mu\text{s}, T_c = 25^\circ\text{C}$ Duty Cycle $\leq 1\%$	t_d	--	0.1	0.2	μs
Rise Time		t_r	--	0.6	1	μs
Storage Time		t_{STG}	--	2	4	μs
Fall Time		t_f	--	0.2	0.6	μs
Delay Time	$V_{CC} = 125\text{V}, I_C = 0.4\text{A}, I_{B1} = 15\text{mA}, I_{B2} = 150\text{mA}, t_p = 25\mu\text{s}, T_c = 25^\circ\text{C}$ Duty Cycle $\leq 1\%$	t_d	--	0.10	0.13	μs
Rise Time		t_r	--	0.38	0.51	μs
Storage Time		t_{STG}	--	0.34	0.43	μs
Fall Time		t_f	--	0.03	0.05	μs
Delay Time	$V_{CC} = 125\text{V}, I_C = 0.4\text{A}, I_{B1} = 15\text{mA}, I_{B2} = 150\text{mA}, t_p = 25\mu\text{s}, T_c = 120^\circ\text{C}$ Duty Cycle $\leq 1\%$	t_d	--	0.13	--	μs
Rise Time		t_r	--	0.66	--	μs
Storage Time		t_{STG}	--	0.25	--	μs
Fall Time		t_f	--	0.05	--	μs

Note: pulse test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 2\%$

Electrical Characteristics Curve ($T_c = 25^\circ\text{C}$, unless otherwise noted)

Figure 1. Static Characteristics

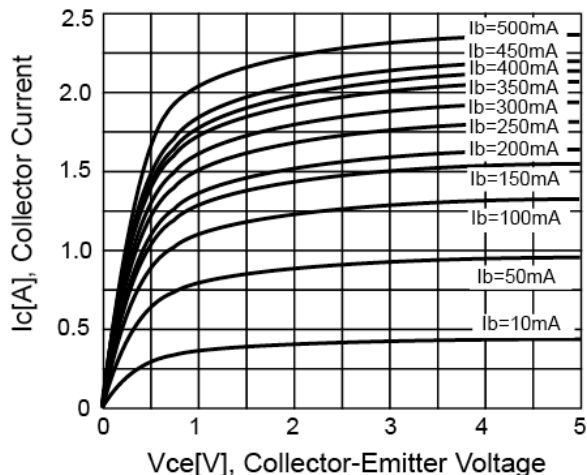


Figure 2. DC Current Gain

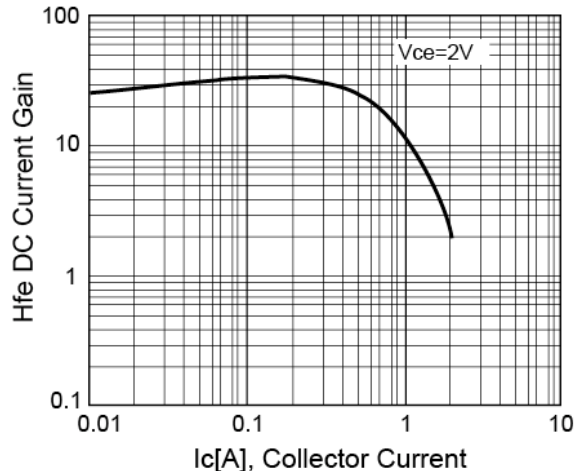


Figure 3. $V_{CE(SAT)}$ v.s. $V_{BE(SAT)}$

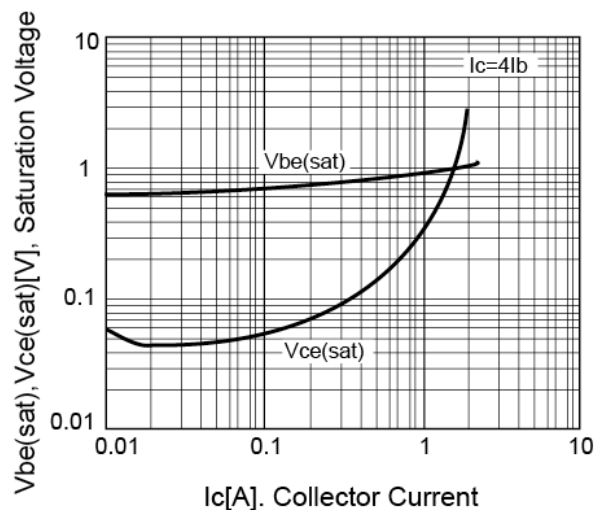


Figure 4. Power Derating

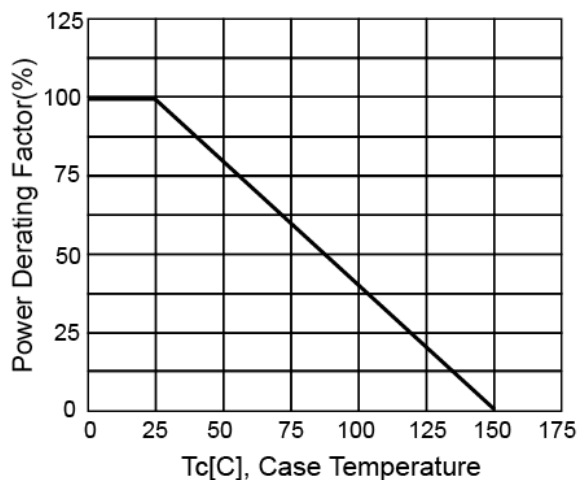


Figure 5. Reverse Bias SOA

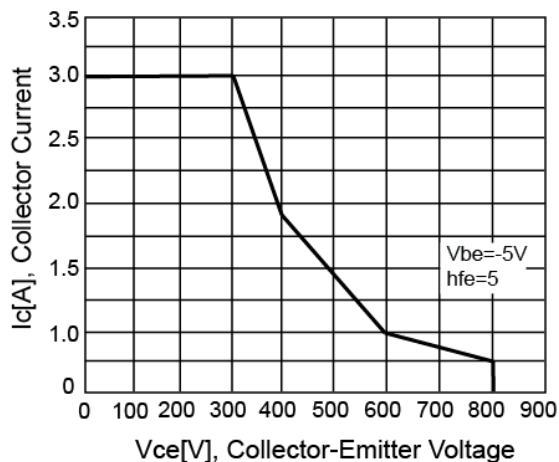
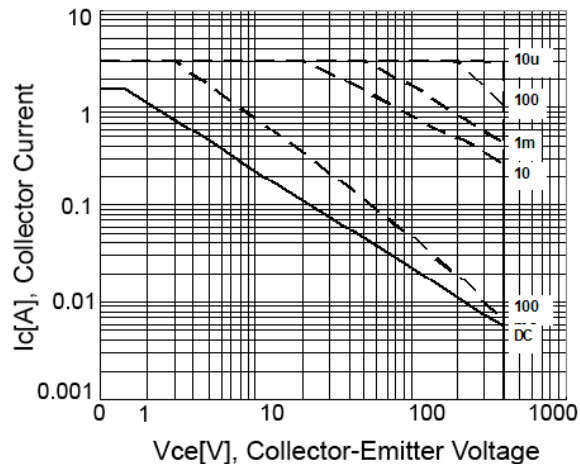


Figure 6. Safety Operating Area

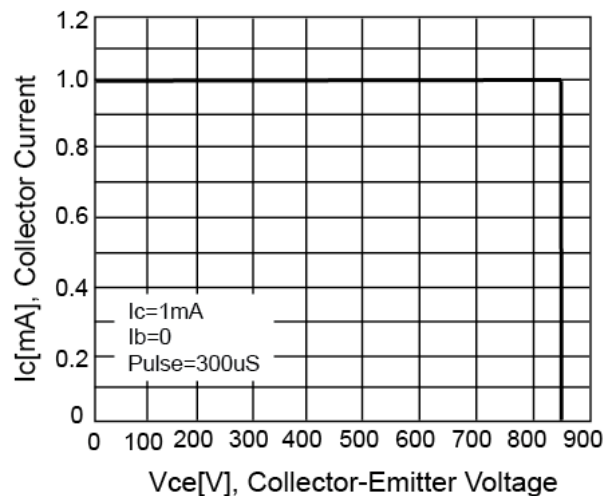


TS13003MV

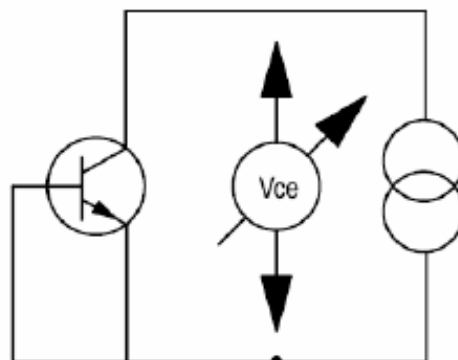
High Voltage NPN Transistor

Electrical Characteristics Curve ($T_c = 25^\circ\text{C}$)

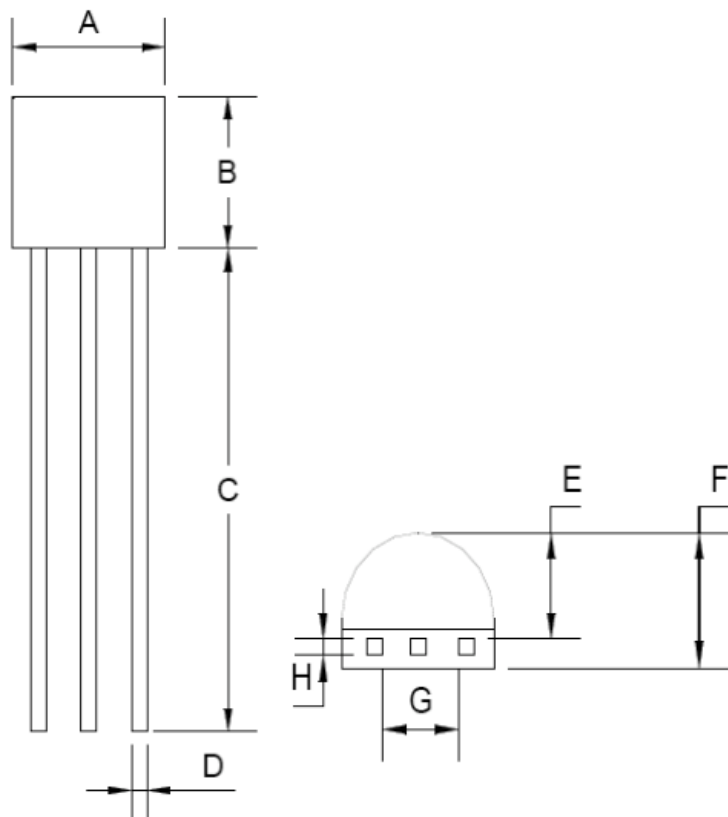
Figure 7. Vces Curve



Vces Test Circuit

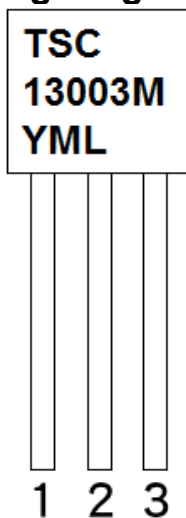


TO-92 Mechanical Drawing



TO-92 DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	4.30	4.70	0.169	0.185
B	4.30	4.70	0.169	0.185
C	14.30(typ)		0.563(typ)	
D	0.43	0.49	0.017	0.019
E	2.19	2.81	0.086	0.111
F	3.30	3.70	0.130	0.146
G	2.42	2.66	0.095	0.105
H	0.37	0.43	0.015	0.017

Marking Diagram



Y = Year Code

M = Month Code

(A=Jan, B=Feb, C=Mar, D=Apl, E=May, F=Jun, G=Jul, H=Aug, I=Sep, J=Oct, K=Nov, L=Dec)

= Month Code for Halogen Free Product

(O=Jan, P=Feb, Q=Mar, R=Apl, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)

L = Lot Code

TS13003MV

High Voltage NPN Transistor

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